The Utilization of Juice *Morinda citrifolia* and *Averrhoa bilimbi* as a Latex Emulsifier Agent

Marlina Kamelia [*]***, Khairul Anam, Netriwati, Rina Budi Satiyarti, Dwijowati Asih Saputri, Nurhaida Widiani***

Faculty of Education and Teacher Training University of Islamic State Raden Intan Lampung

**email: marlinakamelia@radenintan.ac.id*

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ABSTRACT

The area of rubber land in Indonesia currently reaches 3,672,213 ha which can produce 3,229,861 tons/year. The price of rubber in Indonesia is currently cheap because of low-quality latex. The low quality of latex is caused by the large production costs, one of which is the price of latex clotting material which is relatively expensive. Therefore, this studied aims to find a good alternative to latex coagulant but at low cost. Latex clumping material used in this research were noni juice and star fruit. The treatment in this study used noni juice and star fruit juice concentration of 5 ml, 10 ml, 15 ml, and 20 ml, respectively. The results showed the weight of latex with noni emulsifying agents increased by 45.58% while the administration of star fruit juice was not much different, amounting to 45.70%. However, the final weight of latex given by the emulsifying agent in the form of star fruit was higher than Noni with the difference at the highest weight reached 4.23 grams. The fastest latex clumping time at 20 ml star fruit concentration is 1.18 minutes. Based on research results noni juice and star fruit potential as a latex clot.

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Introduction

The area of rubber plantations in Indonesia reached 3,672,123 hectares with an annual production of 3,229,861 tons (Sub Direktorat Statistik Tanaman Perkebunan, 2016). This number shows great potential for meeting the needs of rubber farmers. Rubber production is also one of the pillars of the country's economy. This can be seen in the number of products made from rubber such as: tires, mattresses, balls, and so on. In addition, natural rubber is also widely exported to foreign countries. However, today's rubber prices are very low, ranging between Rp. 5,000.00 to 6,000.00 for each kilogram (Antoni & Purbiyanti, 2015). This condition is certainly a problem for rubber farmers because they have to reduce production costs to keep making a profit. Production costs that consume a number of funds are synthetic latex emulsifiers because the price is still quite expensive (Pratama, 2018).

Latex is a white liquid obtained from the tapping of the plant *Hevea brasiliensis*. The tapping latex is white and resembles milk and contains rubber granules which are colloid solutions. Latex contains 25 - 40% of raw materials, 60 - 70% of serum consisting of solutes and water (Maryanti & Edison, 2016).

The process of emulsifying latex is influenced by the nature of the acid, latex will clot if the electric charge is lowered (dehydration), the pH of the latex is lowered (addition of acid H+) and the addition of electrolytes. Latex coagulation is an event that occurs due to changes in the sol to gel phase assisted by coagulant (Purnomo et al., 2015).

Synthetic latex emulsifiers which are widely used today are chemicals with acidic properties. Acidic chemicals used include: acetic acid, liquid smoke, formic acid, sulfuric acid, and TSP (Efendi et al., 2018). In addition to the expensive price, this chemical is also dangerous if inhaled and enters the respiratory tract. Therefore, it is important to look for alternatives to natural latex emulsifiers which are cheap and safe for health (Selpiana et al., 2015).

Noni fruit contains acetic acid, benzoic acid, caprylic acid, phenolics, flavonoids, and ascorbic acid. While starfruit contains ascorbic acid, oxalic acid, citric acid, lactic acid, and malic acid. The content of ascorbic acid in these two fruits has the potential to emulsify latex (Lisnawati & Prayoga, 2020). In addition, noni and starfruit have sufficient availability in nature but are still rarely used so that these potentials can be used as emulsifiers for natural latex. This is in line with previous research on natural latex emulsifiers that have been used such as yam tubers, *Otaheite gooseberry* juice and palm sap which also contain ascorbic acid (Ali et al., 2014).

Materials and Methods

This study used a quantitative descriptive method designed with a *completely randomized design* (CRD) consisting of 8 treatments, namely noni with a concentration of 5 ml, 10 ml, 15 ml, 20 ml and star fruit with a concentration of 5 ml, 10 ml, 15 ml, 20 ml. Each treatment was repeated 3 times. In the emulsion test each treatment was tested with 20 ml of latex. The parameters measured included ascorbic acid levels, pH, weight and time of emulsifying latex with noni juice and starfruit juice. The stages of the research are as follows:

Preparation the sample

The sample used is noni fruit and star fruit from Kalirejo village, Katon Negeri District, Pesawaran Regency. The fruit must meet the criteria for being ripe, yellow or pale yellow, and not rotten.

Making fruit juice

Noni and star fruit that has been prepared then taken the juice using a juicer. Each fruit is extracted as much as 250 ml.

Measuring the pH of fruit juice

The juice is then measured using a pH meter to determine the degree of acidity before being tested.

Calculating ascorbic acid levels

Fruit juice was then measured ascorbic acid levels with a spectrophotometer at a wavelength of 265 nm - 271 nm assisted with a standard solution of ascorbic acid.

Latex emulsifying process

Taken in the morning to avoid pre-coagulant. The latex is then filtered and then mixed with fruit juice according to a predetermined volume and stirred until homogeneous.

Counting time and weight latex

The latex is mixed with various juices and then the collection time is calculated to determine which juice will coagulate faster. The time is calculated using a stopwatch since mixing takes place. Latex weight is measured with a digital scale. Latex that has been frozen is weighed to look heavy after being emulsified. Latex is weighed starting from the first hour after emulsifying up to the next five hours to get the maximum weight.

Results and Discussion

1. pH of fruit juice

The results of the test of juice noni and star fruit using a pH meter can be seen in Figure 1.

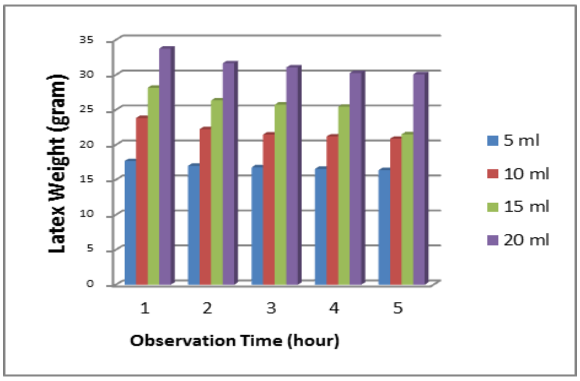

Figure 1. The Graph of pH of Emulsifying Agent

Figure 1 show noni juice has a pH of 4.25 while the starfruit juice is much more acidic 1.34. This shows that the acid content in starfruit is much higher than noni. However, both of them have potential as emulsifying agents because when mixed with latex they can reduce the pH to between 5.5 and 377. This decrease occurs because of the acidic compounds they contain. The acidity level of fresh latex is 6.8-7.0. At this pH the latex is stable and will not clot. Decrease and increase in pH due to the administration of emulsifying agents will affect the latex condition so that the emulsion process occurs (Suwardin & Purbaya, 2015).

2. Ascorbic acid

Acid test ascorbic levels the testing process begins by making a calibration curve of a standard solution of vitamin C which is used as a basis for measuring absorbance using a measured maximum wavelength. Figure 2 are ascorbic acid levels in star fruit and noni star fruit juice.

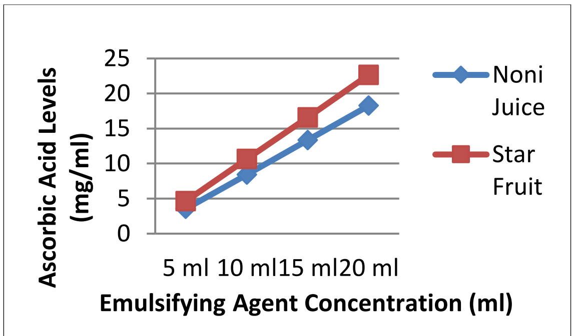

Figure 2. The Graph of Ascorbic Acid Levels

Figure 2 shows the different amounts of ascorbic acid levels in various volumes of fruit juice. It appears that the amount of ascorbic acid levels increases with the volume of fruit juice. The greater the volume of fruit juice, the greater the ascorbic acid value. The highest ascorbic acid extract is in the volume of 20 ml which is 18.26 mg / ml for Noni juice while star fruit juice is 22.67 mg / ml. It shows that star fruit has higher levels of ascorbic acid than noni so it has more potential as a latex clotting agent.

3. Time of Latex Emulsification

The time of emulsification is done by mixing 20 ml of latex with noni juice and star fruit with different concentrations and the time of emulsification is calculated. This can be seen in the figure 3.

Figure 3 shows the time of emulsification of different latex from noni juice and star fruit. The fastest time to emulsify latex in noni with a concentration of 10 ml is 1.32 minutes and the longest at a concentration of 20 ml is 2.16 minutes. This is different from giving star fruit juice as an emulsifier. The fastest emission of latex at star fruit with a concentration of 20 ml is 1.18 minutes and the longest at a concentration of 5 ml is 2.52 minutes.

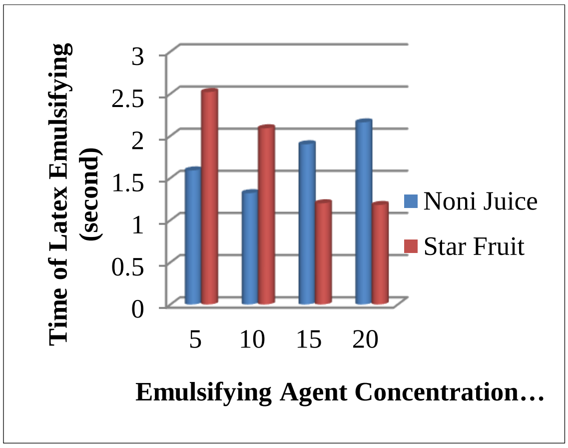

Figure 3. The Graph of Time Latex Emulsifying

The speed of latex emulsifying time is suspected because the right comparison of juice and latex concentrations mixed with homogeneous can increase the interaction of coagulant and latex to be perfect. Latex emulsifies when the amount of latex is less than the coagulant or the number of coagulants is very small so that the interaction of latex particles becomes less than optimal. This happens because the purpose of emulsification is to unite the granules in the latex liquid with the help of the coagulant (Laoli et al., 2013).

4. Latex Weight

Weight was calculated after emulsification using noni juice and star fruit juice. Latex weight is weighed from the first hour to the 5th hour to reach a constant weight. Figure 4 shows the difference in weight of latex by giving noni juice from the first to the fifth hour.

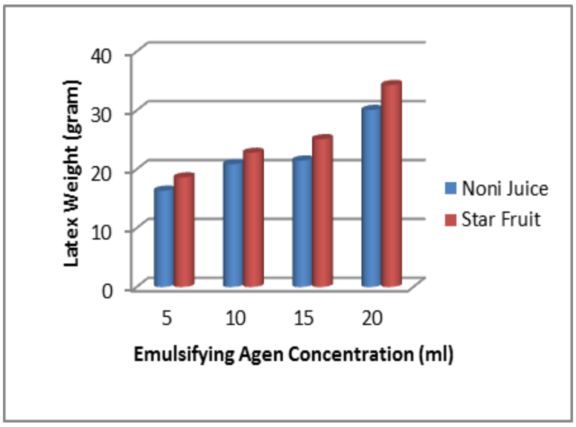

Figure 4. The Graph of Latex Weight After Emulsifying with Noni Juice

Figure 4 shows a decrease in latex weight from the first to the fifth hour after giving the emulsifying agent in the form of noni juice. Noni juice with a concentration of 20 ml which shows the highest latex weight since the first hour and reaches a heavy stability at the fifth hour that is 30.08 grams. However, what is unique about this emulsifying process is that the smaller the concentration of the emulsifying agent, the smaller the reduction in weight. Consequently, the percentage weight loss rate of 5 ml, 10 ml, 15 ml, and 20 ml emulsifying agents were 7.36%, 12.42%, 23.62%, and 10.87%. The average percentage of latex weight reduction in treatment with noni emulsifying agents was 13.57%. This happens because the latex is at its optimum condition, where the water content starts to little or even not already in the latex. Latex weight loss every hour because when an acid is put into a latex emulsion, it can make the colloidal particles unstable and cause the protein structure in the latex to be disrupted. This situation has all the emulgators broken. So that at a longer mixing time, the amount of latex produced will decrease (Ali et al., 2014).

The weight of latex agglomerated with emulsifying agents in the form of star fruit also showed differences. This is as shown in the Figure 5.

Figure 5 explains that giving a larger emulsifying agent will also have a large effect on increasing the weight of latex. Latex weight observed from the first to the fifth hour showed a decrease in weight until it reached a constant weight (Arizki, 2020). The highest weight of latex was seen in the treatment of 20 ml emulsifying agent which reached stability at the fifth hour which was 34.31 grams. The rate of latex weight reduction in the treatment with emulsifying agents in the form of star fruit in succession from low to high concentrations was 4.51%, 3.63%, 3.53%, and 3.16%. The average rate of reduction of latex weight in this treatment was 3.71%. This shows that the weight of latex with star fruit emulsifying agent is more stable than noni.

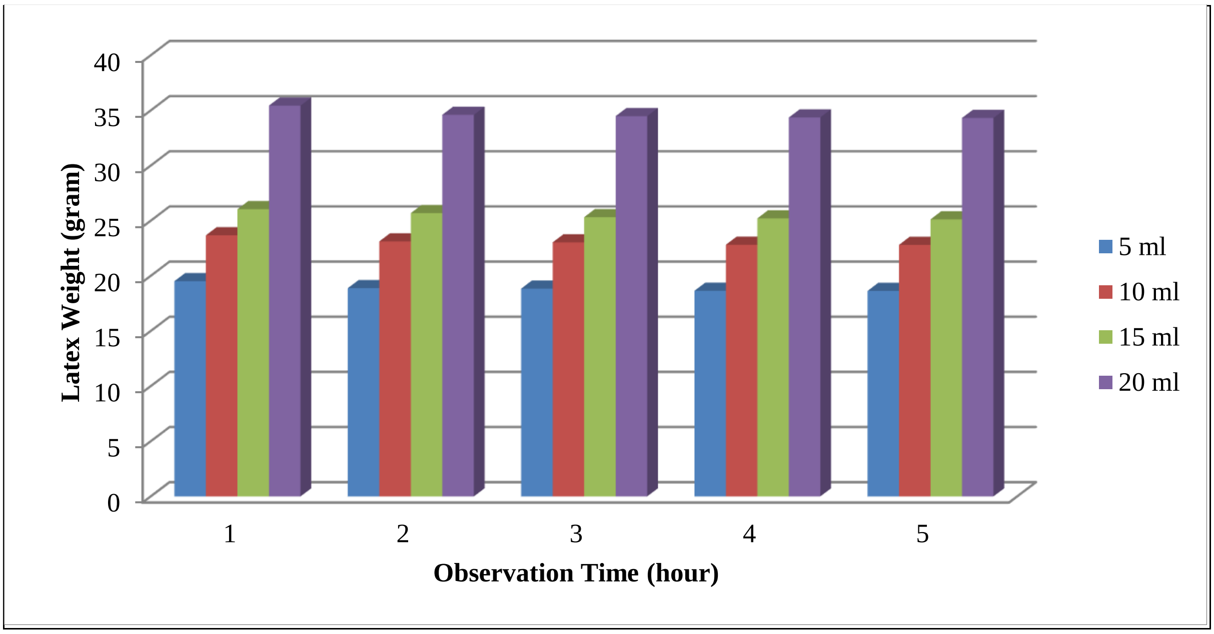

Figure 5. The Graph of Latex Weight After Emulsifying with Star Fruit

Figure 6 shows the comparison of latex final weight with noni emulsion and star fruit emulsifying agent.

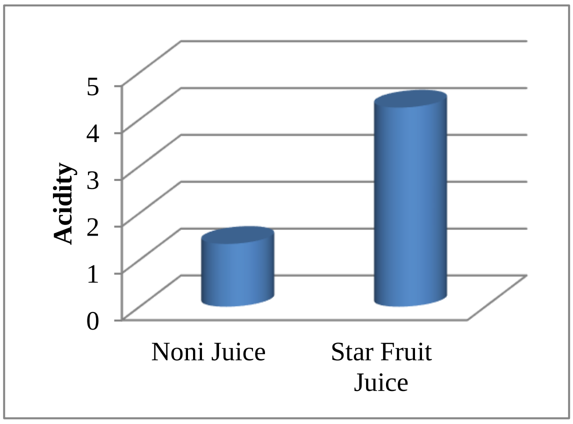

Figure 6. The Graph of Latex End Weight

Figure 6 presents data of latex final weight after being emulsified for 5 hours. The data above shows that the greater the concentration of the emulsifying agent given, the higher the weight of latex (Nasution, 2016). The weight of latex with noni emulsifying agents increased by 45.58% while the administration of star fruit juice was not much different, which amounted to 45.70%. However, the final weight of latex given by emulsifying agent in the form of star fruit was higher than noni with the difference at the highest weight reaching 4.23 grams. The treatment which has the greatest and most effective weight is found in star fruit juice with a concentration of 20 ml. This is thought to be due to the volume of 20 ml of noni juice so that the latex binding process is more and makes the latex to have a large weight. This is also in line with the potential of ascorbic acid contained by star fruit (Febriani et al., 2019). Ascorbic acid has the potential to produce latex weight because the more the amount of emulsifying volume, the more rubber particles will unite so that it will form a larger coagulum (Handayani, 2014).

Conclusion

The results of the research that have been carried out show that noni and starfruit can be used as latex coagulation agents because of the ascorbic acid they contain. The greater the concentration of fruit juice, the more effective it is as coagulation. Emulsifying agents given 20 ml of noni juice have the highest latex weight as well as star fruit juice. Star fruit has more effective results as a latex emulsifier.

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